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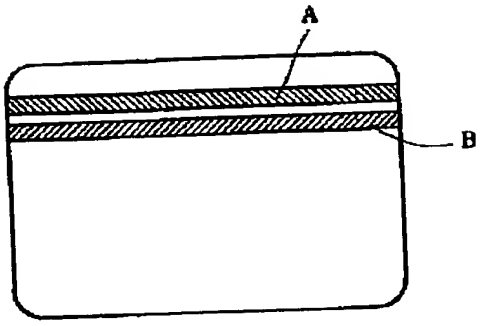
TITLE : MAGNETIC RECORDING MEDIUM AND ITS RECORDING AND REPRODUCING METHOD



ABSTRACT : PROBLEM TO BE SOLVED: To obtain a magnetic recording medium having firm security property by forming the magnetic recording medium to have a magnetic layer containing a magnetic powder essentially comprising a MnBi magnetic powder and a magnetic powder which can be recorded, erased and rewritten with a magnetic head.

SOLUTION: This magnetic recording medium has a magnetic layer containing a magnetic powder essentially comprising MnBi and a magnetic powder in which recording, erasing and rewriting can be done with a magnetic head. The magnetic layer has a region (B) where signals can be arbitrarily rewritten, and a region (A) where once a signal is recorded, it is hardly rewritten. Namely, the medium has both of a normal magnetic recording medium and a region where once a signal is recorded, it is hardly rewritten after that. Therefore, the obtd. medium is suitable for such a card that two kinds of data are recorded in the card, the one kind of data for which rewriting is inhibited such as for a prepaid card, and the other data which requires rewriting every time the card is used.

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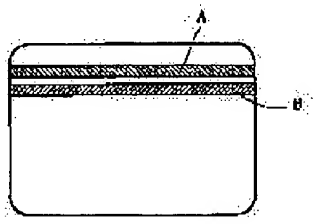
(54) MAGNETIC RECORDING MEDIUM AND ITS RECORDING AND REPRODUCING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a magnetic recording medium having firm security property by forming the magnetic recording medium to have a magnetic layer containing a magnetic powder essentially comprising a MnBi magnetic powder and a magnetic powder which can be recorded, erased and rewritten with a magnetic head.
SOLUTION: This magnetic recording medium has a magnetic layer containing a magnetic powder essentially comprising MnBi and a magnetic powder in which recording, erasing and rewriting can be done with a magnetic head. The magnetic layer has a region (B) where signals can be arbitrarily rewritten, and a region (A) where once a signal is recorded, it is hardly rewritten. Namely, the medium has both of a normal magnetic recording medium and a region where once a signal is recorded, it is hardly rewritten after that. Therefore, the obtd. medium is suitable for such a card that two kinds of data are recorded in the card, the one kind of data for which rewriting is inhibited such as for a prepaid card, and the other data which requires rewriting every time the card is used.



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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to magnetic-recording media, such as a magnetic card in which the field which is not easily rewritable once it has the magnetic layer which contains the magnetic powder in which record, elimination, and rewriting are possible by MnBi magnetism powder and the magnetic head in a magnetic layer and records a signal on it, and the field which can perform rewriting of a signal arbitrarily were made to form, and the record reproduction method of this magnetic-recording medium.
[0002]
[Description of the Prior Art] Since record reproduction is easy for a magnetic-recording medium, it has spread widely as videotape, a floppy disk, a credit card, a prepaid card, etc. However, the feature that record reproduction is easy The recorded data are easy to be eliminated accidentally, and the problem that the alteration of data can also be performed easily is generated. on the contrary, for example In the case of a magnetic card, it is eliminated with the magnet of a strong magnetic field with which various doors, a handbag, etc. are increasingly used for our familiar place, or the accident and the crimes of data being rewritten and being used improperly of a magnetic card are occurring frequently recently.
[0003] Although the record medium whose rewriting is impossible, and the alteration of data are difficult and the high IC card of security nature etc. is proposed once it makes a record medium cause an irreversible change and records on it by the laser beam like an optical card as this cure, for example In the case of an optical card, the expensive equipment only for optical cards which records an optical card and is reproduced is newly needed. Moreover, in an IC card, in order to use a semiconductor, there is a difficulty of becoming quantity cost, and it has not spread, so that it comes to substitute for neither with record of the magnetic card which has spread all over the world, and a regenerative apparatus and it is still expected.
[0004] Therefore, although giving printing which the policy which prevents the alteration of a magnetic card was proposed variously, for example, made full use of hologram printing or advanced printing technology to the magnetic card is performed Even if it can demonstrate effect in that the forgery on the appearance of a card is prevented by this method, this alteration For example, it is carried out by writing the data read in others' credit card in the regular credit card which came to hand with the unjust means etc., and since the written-in data are regular, this cannot be prevented.
[0005] On the other hand, the magnetic-recording medium which uses MnBi magnetism powder as a record element Having the feature that it will not be easily eliminated at a room temperature once it records a signal is known. JP,52-46801,B, JP,54-19244,B, and JP,54-33725,B -- JP,57-38962,B, JP,57-38963,B, JP,59-31764,B, Especially, data are eliminated accidentally or it is observed as what can prevent accident and an unauthorized use today when the reader for magnetic cards has spread to all the corners in the world in a credit card, a money card, etc. with which accident and crimes, such as being rewritten intentionally, are occurring frequently.
[0006]
[Problem(s) to be Solved by the Invention] Thus, although the magnetic-recording medium which used MnBi magnetism powder as a record element is the optimal medium for media which are only reproduction and do not have the need of rewriting if a signal is recorded once, such as a credit card and a money card, it does not fit a use in which two kinds of data, the data which must not be rewritten, and data with the need of rewriting data at every use of a card, are written like PURIPE-DOKA-DO.
[0007] That is, like PURIPE-DOKA-DO, since rewriting of the record data based on a magnetic recording medium is needed, by the magnetic layer only containing MnBi magnetism powder, rewriting of record data becomes difficult and is not suitable for the above-mentioned use in the thing of the method which rewrites the balance, corresponding to use.
[0008] On the other hand, although record data need to be rewritten, in order to prevent the alteration of the record data of a card simultaneously by PURIPE-DOKA-DO according to use, an irreversible change is made to usually, cause so that the reuse of the hole cannot be opened and carried out to a card each time of use, or when a signed off is carried out. However, since it can distinguish a busy condition easily visually, by filling this hole, such ****** is comparatively easy for returning to an intact state, and the card altered by such [actually] method is used unjustly, and it has been a big problem socially.
[0009] this invention is what was made as a result of examining many things in view of this present condition. By considering as the magnetic powder which makes MnBi magnetism powder a subject, and the magnetic-recording medium which has the magnetic layer which contains both the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head Postscript writing is performed according to use, maintaining a rewriting function (rewrite function). And this data that

carried out postscript writing offers the magnetic-recording medium which has the property which has not been realized by subsequent rewriting and the conventional magnetic-recording medium that elimination has a very difficult property (write-once function). It aims at offering the record for demonstrating this function, and the reproduction method.
[0010] Furthermore, in the case of the card, this invention writes in data beforehand further at the above-mentioned rewrite function and the write-once function at the time of issue, and this data aims at offering a magnetic-recording medium with more powerful security nature by giving the function (lead-only function) in which subsequent rewriting and elimination become very difficult.
[0011]
[Means for Solving the Problem] It has the magnetic powder which makes MnBi a subject, and the magnetic layer which contains the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head, when a signal is once recorded with the field where rewriting of a signal can do this magnetic layer arbitrarily, rewriting has a difficult field, for example, the magnetic-recording medium of this invention prepares this magnetic layer in card-like one side or both sides of a substrate, and is using it as the card-like magnetic-recording medium.
[0012] Moreover, the record method of the magnetic-recording medium this invention The signal which can do rewriting for this magnetic layer arbitrarily after cooling at low temperature and changing into a demagnetization state the magnetic layer of the magnetic-recording medium which has the magnetic powder which makes MnBi a subject, and the magnetic layer which contains the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head, When it records once further], rewriting is the method of recording a difficult signal, and it sets to this method. After cooling a magnetic-recording medium at low temperature and changing into a demagnetization state, as a signal which can do rewriting arbitrarily A magnetic field is impressed to the fields where a magnetic layer is arbitrary, it is magnetized, and a signal is recorded further after that, and further, this field is the method of recording a signal, after rewriting will impress a magnetic field and will be magnetized as a difficult signal, if it records on a different field once.
[0013] Furthermore, the reproduction method of the magnetic-recording medium this invention The magnetic powder which makes MnBi a subject, and the field where it has the magnetic layer which contains the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head, and rewriting of a signal can do this magnetic layer arbitrarily, In the magnetic-recording medium by which rewriting has a difficult field when a signal is recorded once, if a signal is recorded once, after rewriting will impress a magnetic field to a difficult field and will be magnetized, it is the method of reproducing a signal.
[0014] In the magnetic-recording medium of such this invention, if direct-current demagnetization of the arbitrary fields is carried out after cooling and demagnetizing a magnetic-recording medium at low temperature first (initialization), this field will be rewritten like the usual magnetic-recording medium, and will turn into an eliminable field (rewrite function).
[0015] Because, since MnBi magnetism powder will be magnetized if a magnetic field is impressed after cooling a magnetic-recording medium at low temperature and changing into a demagnetization state, and coercive force becomes very large, in order to record data after that, even if it impresses the magnetic head to a magnetic field, magnetization of MnBi magnetism powder will not change, and reading of data will not be affected. On the other hand, it is recorded on the magnetic powder in which record, elimination, and rewriting are possible by the magnetic heads other than MnBi magnetism powder by the magnetic field from the magnetic head corresponding to data. Therefore, in this field, data are arbitrarily rewritable like the usual magnetic-recording medium (rewrite function).
[0016] On the other hand in other arbitrary fields, postscript record of the data is carried out according to use of the magnetic-recording medium. Although data with meanings, such as a character and a number, are sufficient as this data, you may be a thing about [equivalent to ****** currently carried out by usual PURIPE-DOKA-DO etc.] marking. Although postscript writing can do this data, it rewrites and elimination becomes very difficult.
[0017] Because, the data recorded after cooling the magnetic-recording medium at low temperature and changing into a demagnetization state are recorded also on MnBi magnetism powder by the magnetic head by the magnetic powder in which record, elimination, and rewriting are possible. If it is going to rewrite this data, although the data of magnetic powder other than MnBi magnetism powder will be rewritten, eye a difficult hatchet and different data are extremely intermingled by rewriting, and the data recorded on MnBi magnetism powder cause a reading error. If magnetized once, the coercive force of MnBi magnetism powder will become very large, and subsequent demagnetization will depend this on the property peculiar to MnBi magnetism powder to become very difficult. Therefore, the data written in this field turn into high data of security nature with very difficult subsequent rewriting and elimination (write-once function).
[0018] Moreover, it is fields other than the above-mentioned field which carried out direct-current demagnetization, and it is desirable to write fixed data in fields other than the field further used as a write-once field beforehand at the time of magnetic-recording medium issue. It is desirable to write in the data which must not be rewritten at the time of the amount of money and the date of issue etc. as this data, for example, in applying to a card.
[0019] Furthermore, as for the data written in this field, reproducing, after demagnetizing is desirable. By this demagnetization processing, the data recorded on the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head will be read, if it reproduces after demagnetizing the magnetic-recording medium only containing this magnetic powder, since it will be eliminated, and they cause an error. Therefore, the forged magnetic-recording medium which does not contain MnBi magnetism powder is eliminated, and can prevent not only the data alteration of a magnetic-recording medium but forgery of the magnetic-recording medium itself (lead-only function).
[0020] Moreover, by recording beforehand the information about the field which has each aforementioned function on the specific

field of a magnetic-recording medium, and rewriting pinpointing a difficult field and a rewritable field and carrying out record reproduction according to this information, it also becomes possible to make it the record position of the field where rewriting is difficult, and a rewritable field change altogether with cards, and very powerful security is obtained.

[0021] The magnetic-recording medium of this invention thus, by considering as the magnetic powder which makes MnBi magnetism powder a subject, and the magnetic-recording medium which has the magnetic layer which contains the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head Maintaining a rewriting function, postscript writing is performed according to use and the data in which the parenthesis carried out postscript writing realize the unique and practically very useful property which was not seen to the old magnetic-recording medium subsequent rewriting and elimination have a medium and a very difficult property.

[0022] Furthermore, the magnetic-recording medium of this invention demonstrates power, especially when it applies to magnetic-card fields, such as various PURIPE-DOKA-DO, a magnetic commuter pass, a magnetic ticket, a credit card, and a money card.

[0023] Moreover, since this invention demonstrates a rewrite function after cooling especially this magnetic-recording medium at low temperature and changing into a demagnetization state, the record method for making the above-mentioned magnetic-recording medium demonstrate such a unique property, and In order to offer the record method peculiar to this magnetic-recording medium of recording the backward signal which impressed the magnetic field to the fields where a magnetic layer is arbitrary, and was magnetized and to use a lead-only function effectively further The reproduction method peculiar to this magnetic-recording medium of reproducing after demagnetizing lead-only data beforehand is offered.

[0024]

[Embodiments of the Invention] The field where the magnetic-recording medium of this invention has the magnetic powder which makes MnBi a subject, and the magnetic layer which contains the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head, and rewriting of a signal can do this magnetic layer arbitrarily, Once rewriting has a difficult field when a signal is recorded once, and it records a signal, the field where subsequent rewriting is difficult (a write-once function, lead-only function), It is what has the field (rewrite function) which can do rewriting arbitrarily like the usual magnetic-recording medium simultaneously. This feature is the the best for a use in which two kinds of data, the data which must not be PURIPE---DOKA---DO-etc.-rewritten, and data with the need of rewriting data at every use of a card, are written.

[0025] Moreover, once it records a signal on the same magnetic-recording medium, in order to form the field where rewriting is difficult, and the field which can do rewriting arbitrarily like the usual magnetic-recording medium in this invention Once it records a signal first, in the field where rewriting is difficult, it records by the usual method using the magnetic head, and after impressing a magnetic field first and magnetizing this field, the special record method of recording using the magnetic head by the usual method will be used for the field whose rewriting is possible for arbitration on the other hand.

[0026] Hereafter, this invention is explained in detail. First, MnBi magnetism powder will fall, if temperature falls at a room temperature, although coercive force is as high as about 12000 Oe(s), and is set to 1500 or less Oes by 100K so that clearly from drawing 1 which shows an example of the temperature dependence of coercive force. Therefore, it can demagnetize by cooling at low temperature using this property, and after demagnetization can be easily magnetized at a room temperature.

[0027] Moreover, if it cools at low temperature and changes into a demagnetization state so that clearly also from drawing 2 which shows the initial magnetization curve of the magnetic-recording medium using this MnBi magnetism powder, it is easily magnetizable at a room temperature with the low magnetic field of about 2000 Oes. However, once it magnetizes this magnetic-recording medium, the high coercive force of about 14000 Oes will come to be shown, and elimination and rewriting of subsequent data will become almost impossible.

[0028] Drawing 3 is what illustrated the elimination property of a magnetic card of having used such a magnetic-recording medium, with the magnetic card using the iron-oxide magnetism powder usually used, if the magnetic field of about 1000 Oes is impressed, it will be demagnetized nearly completely, and a reproduction output becomes zero mostly, and it is shown that the data of the usual magnetic card can rewrite this easily. On the other hand, with the magnetic card using MnBi magnetism powder, even if it impresses the magnetic field of about 5000 Oes, the output shows that the thing which were done about 30% and to rewrite is very difficult, once the output still remains about 50% and this records data, even if it does not decrease and impresses the magnetic field of about 8000 Oes.

[0029] When it considers as a MnBi ingot by powder-metallurgy processing, the arc furnace solution process, the RF solution process, the melt extraction, etc., and this is ground, and it is manufactured, for example, it manufactures with powder-metallurgy processing, the MnBi magnetism powder of this invention is divided into the process which produces an ingot, the process which grinds this, and a stabilizing treatment process, and is manufactured as follows. In addition, it is not necessarily based on the grinding method, but is good also as MnBi magnetism powder.

[0030] First, production of an ingot fully mixes Mn powder of 50-300 meshes, and Bi powder, carries out the pressurization press of this, and considers as a molding object, and an ingot is produced. In addition, although it is desirable to perform this mixture in an inert atmosphere, you may mix in an oxidizing atmosphere.

[0031] When mixing Mn powder and Bi powder, if it is desirable to make it the range of 45:55 to 65:35 by the mole ratio as for the ratio (Mn/Bi) and it makes [many] Mn compared with Bi, when it considers as MnBi magnetism powder, by forming the oxide and hydroxide of Mn in the front face, the corrosion resistance of MnBi magnetism powder will improve and good magnetic powder will be obtained. For this reason, it is more desirable to make [many] Mn compared with Bi.

[0032] Although it is desirable that the content of an impurity uses a few thing as Mn powder used here and Bi powder, when

adjusting magnetic properties, metals, such as nickel, aluminum, Cu, Pt, Zn, and Fe, are used for this, adding to it. When adding such a metal, since magnetic properties can be controlled good, the crystal structure of MnBi itself can be maintained good by making it fewer than 5.0 atom % and the property of MnBi original can be demonstrated by carrying out to more than 0.6 atom % to MnBi, as for the addition, it is desirable to make it become within the limits of 0.6 - 5.0 atom %. Moreover, as these addition methods, it is desirable to make the alloy of Mn and these elements beforehand.

[0033] Moreover, what was ground beforehand may be used as Mn powder or Bi powder, pulverization of the lumps, such as flakes or a shot, may be carried out by pulverization, and they may be used. Since a generation reaction will progress smoothly and a reaction will be greatly influenced by front-face nature if Mn powder and Bi powder use what carried out pulverization to 50-300 meshes in order that MnBi may generate by the diffusion reaction which lets the contact interface of Mn and Bi pass, in compounding by the sintering reaction, it is desirable in performing surface treatment currently performed with powder-metallurgy processing, such as **********ing or degreasing Mn powder and Bi powder front face with a solvent. Mixture of these Mn powder and Bi powder is performed with arbitrary meanses, such as an automatic mortar and a ball mill.

[0034] When carrying out the pressurization press of Mn powder and the Bi powder and considering as a molding object, welding pressure is 1 - 8 t/cm2. If it is desirable, and carrying out carries out a pressurization press with such welding pressure and it considers as a molding object, a sintering reaction will be promoted and a uniform ingot will be produced. By making welding pressure into two or more 1 t/cm, a MnBi ingot can be made more into homogeneity and it is 8 t/cm2. Productivity can be improved by considering as the following.

[0035] The acquired molding object is sealed by a glassware or the metal vessel, the inside of a container is made into a vacuum or inert gas atmosphere, and the oxidization under heat treatment is prevented. As inert gas, although hydrogen, nitrogen, an argon, etc. can be used, nitrogen gas is used as optimal thing from the point of cost. Thus, subsequently to an electric furnace, the container which sealed the molding object is put in and heat-treated for two - 15 days at 260-271 degrees C. Since dissolution of Bi is suppressed and a uniform ingot is obtained by being able to make the amount of magnetization of the ingot obtained high, and considering as 271 degrees C or less while being able to heat-treat in a short time by making heat treatment temperature into 260 degrees C or more, it is desirable to carry out directly under [melting point] Bi.

[0036] Thus, the produced MnBi ingot is taken out, coarse grinding is beforehand carried out in inert gas atmosphere by the automatic mortar etc., and grain size is adjusted to 100-500 micrometers. And dry grinding, such as wet grinding using the shock of the ball using the ball mill, the planet ball mill, etc. or a jet mill, atomizes by the shock by the collision of the particle to the wall of between particles or a container.

[0037] In pulverization using the shock of this ball, if the path of a ball is gradually made small and is ground as pulverization progresses, magnetic powder with a more uniform particle diameter will be obtained. From the first, since it has hexagonal structure, MnBi does not need to show the property which carries out a cleavage and does not need to grind, applying energy high for this reason. using an organic solvent as a liquid in the case of wet grinding -- desirable -- further -- as an organic solvent -- nonpolar [, such as toluene,] -- business -- as for things, it is desirable to use a solvent and to remove the dissolved moisture in a solvent beforehand It is desirable to carry out by the non-oxidizing atmosphere on the other hand in the case of dry grinding. As this non-oxidizing atmosphere, it is used as what has suitable inert gas atmosphere, such as a vacuum or nitrogen gas, and argon gas.

[0038] Thus, the mean particle diameter of the MnBi magnetism powder obtained is in the 0.1-micrometer or more range of 20 micrometers or less, and can control a particle diameter according to pulverization conditions. While being able to enlarge coercive force of magnetic powder enough by being able to make high the saturation magnetization of the magnetic powder finally obtained by making a particle diameter larger than 0.1 micrometers, and being referred to as 20 micrometers or less, the surface smooth nature of the magnetic-recording medium finally obtained becomes good, and can perform sufficient record.

[0039] The MnBi magnetism powder which has the amount of saturation magnetization which the coercive force which impressed and measured the magnetic field of 16kOe according to the above process is in the range of 50-1000Oe in 80K at the range of 3000-150000Oe, and impressed the magnetic field of 16kOe(s) in 300K in 300K, and was measured at the range of 20 - 60 emu/g is obtained.

[0040] Although the MnBi magnetism powder produced by such method can be used as magnetic powder of the field which is not rewritable if it records once which is the magnetic layer of this invention, MnBi magnetism powder is chemically unstable, and since there is a problem on which corrosion advances and magnetization deteriorates when it holds an elevated temperature and under highly humid for a long time, it is desirable to perform processing with being as follows for stabilizing.

[0041] As the stabilizing treatment method of MnBi magnetism powder Near the front face of MnBi magnetism powder, Mn which the MnBi magnetism powder itself has, or Bi is used. The oxide of these metals, The method of forming the coat of a hydroxide, and the method of forming coats, such as a nitride of these metals, or carbide, using Mn or Bi, There is the method of having formed direct or the above-mentioned coat in MnBi magnetism powder upwards furthermore, and making the coat of inorganic substances, such as titanium, silicon, aluminum, a zirconium, and carbon, form further etc. Although each of these methods forms the coat of an inorganic substance in the front face of MnBi magnetism powder, it is also effective to form the coat of the organic substance, such as a surfactant, in the front face of MnBi magnetism powder.

[0042] In these stabilizing treatment methods, there is the method of forming the coat of the oxide of Mn and Bi in the front face of MnBi magnetism powder as a typical thing using oxygen, and the method is explained below.

[0043] In the nitrogen gas containing 100 to about 10000 ppm oxygen, or argon gas, MnBi magnetism powder is first heated at the temperature of 20-150 degrees C. As heating time, about 40 hours is suitable from 0.5 hours. It is desirable that temperature

lengthens this heating time in a low. The oxide of Mn and Bi is formed of this processing. Especially in this processing, the oxide of Mn greatly contributed to the chemical stability of MnBi magnetism powder is formed preferentially.
[0044] Although the oxide coat formed near the front face becomes thick and chemical stability improves so that the degree of this oxidization is enlarged, the initial value of saturation magnetization will fall.
[0045] Although it is difficult to measure the thickness of this oxide correctly, it is desirable to adjust so that it may express with the saturation magnetization of magnetic powder and may become the range of 20 - 60 emu/g in 300K. Since the magnetic powder with saturation magnetization smaller than 20 emu/g has the thick thickness of an oxide coat, although it becomes good chemical stability], a reproduction output when saturation magnetization is too low and considers as a magnetic-recording medium becomes small. Moreover, when larger than 60 emu/g, the thickness of an oxide coat is too thin and inferior to chemical stability.
[0046] Magnetic powder may corrode with the matter produced from the binder resin which the binder resin was disassembled by the catalyst nature when the binder resin whose strong magnetism powder of such catalytic activity is the organic substance in order to use it, making it distribute in the binder resin which the magnetism powder of this state has very strong catalytic activity although the chemical stability of MnBi magnetism powder improves remarkably by the above processings, and is usually the organic substance about magnetic powder by the magnetic-recording medium was touched, and was decomposed further.
[0047] then -- next, MnO2 which is a stable oxide about the oxide of Mn which heat-treats among inert gas further and is formed near the front face of MnBi magnetism powder after performing the above-mentioned processing It changes. This MnO2 As for conversion, it is desirable that it is higher than the above-mentioned heat treatment temperature, and it is desirable to usually make it about 200-400 degrees C. Temperature is a low and MnO2 from 200 degrees C. If conversion is inadequate and it is higher than 400 degrees C, it will become easy to decompose MnBi into Mn and Bi. Moreover, although nitrogen gas and argon gas are usually used as inert gas, the same effect is acquired even if it heat-treats among a vacuum. Furthermore, MnO2 As structure, although gamma type is known further, it is desirable alpha type, beta type, and that catalytic activity makes it smallest beta type, and in order to make it beta type, especially the thing for which heat treatment temperature is made into 300-400 degrees C is desirable.
[0048] By performing such heat treatment, near the front face of MnBi magnetism powder It is mainly MnO2. The oxide coat of Mn expressed is formed and it excels in chemical stability. The mean particle diameter of magnetic powder is in the 0.1-micrometer or more range of 20 micrometers or less. The coercive force which impressed and measured the magnetic field of 16kOe(s) sets to 300K. and in the range of 3000-15000Oe It is in the range of 50-1000Oe in 80K, and the amount of saturation magnetization which impressed and measured the magnetic field of 16kOe(s) in 300K is in the range of 20 - 60 emu/g, and the magnetic powder which was further excellent in the dispersibility in the inside of a binder resin, the stacking tendency, etc. can be obtained.
[0049] The MnBi magnetism powder manufactured as mentioned above is used by the magnetic head with the magnetic powder in which record, elimination, and rewriting are possible. What has the coercive force when impressing and measuring the magnetic field of 16kOe(s) in 300K as magnetic powder in which record, elimination, and rewriting are possible here by the magnetic head in the range of 300Oe(s) to 8000Oe(s) can be used preferably, and the effect of demagnetization can be suppressed by being referred to as 300 or more Oes so that it may mention later, and the function of rewriting can be demonstrated more by being referred to as 8000 or less Oes. As an example of such magnetic powder, oxide magnetism powder, metal magnetism powder, alloy magnetism powder, and compound magnetism powder can be mentioned as a suitable thing.
[0050] As oxide magnetism powder, iron-oxide magnetism powder, such as gamma-acid-ized ferromagnetism powder, magnetite magnetism powder, and gamma-acid-ized iron magnetite middle iron-oxide magnetism powder, chromium-dioxide magnetism powder, the cobalt content iron-oxide magnetism powder that made cobalt contain are used. Moreover, hexagonal-ferrite magnetism powder, such as barium-ferrite magnetism powder, strontium-ferrite magnetism powder, and lead ferrite magnetism powder, is especially used as a suitable thing.
[0051] As metal magnetism powder, the metal magnetism powder which made iron the principal component is used as a suitable thing. Moreover, as alloy magnetism powder, iron-nickel-alloy magnetism powder, iron-cobalt alloy magnetism powder, etc. are used as a suitable thing. Furthermore, it is made to use it as magnetic powder especially suitable when applying the magnetic-recording medium of this invention to magnetic cards, such as PURIPE-DOKA-DO, and a magnetic commuter pass, a magnetic ticket, and hexagonal-ferrite magnetism powder is ****. As this hexagonal-ferrite magnetism powder, barium-ferrite magnetism powder, strontium-ferrite magnetism powder, lead ferrite magnetism powder, etc. are used as a suitable thing.
[0052] Furthermore, as magnetic powder of high coercive force, samarium cobalt magnetism powder or neodium iron boron magnetism powder is raised as suitable magnetic powder.
[0053] In addition, magnetic powder usable as magnetic powder in which record, elimination, and rewriting are possible bears the output of a rewritable field by the magnetic head. Therefore, once the coercive force of MnBi magnetism powder and the direction which is above different to some extent record as this magnetic powder, it will be easy to demonstrate the property of having the field where rewriting is difficult, and an arbitrarily rewritable field. Then, it is desirable that the coercive force when impressing and measuring the magnetic field of 16kOe(s) in 300K as coercive force of the magnetic powder to be used with this MnBi magnetism powder uses the thing of the range of 300-8000Oe.
[0054] Moreover, as for the addition rate of MnBi magnetism powder and other magnetic powder which is magnetic powder in which record, elimination, and rewriting are possible in the magnetic head, it is desirable for a weight ratio to express and to make it the range of 1:9 to 9:1. By making the addition rate of MnBi magnetism powder or more into 1:9, the property (a write-once

function, lead-only function) which is not rewritable once it writes in a signal can be demonstrated more.
[0055] Although MnBi magnetism powder and magnetic powder, such as oxide magnetism powder metallurgy group magnetism powder, contribute, both the reproduction outputs of the field which is not rewritable once it writes [this] in a signal In order that this field may eliminate the forged magnetic-recording medium which does not contain MnBi magnetism powder It is desirable to demagnetize, before reproducing the data currently recorded on this field, and since the output reproduced in this case becomes only what is depended on MnBi magnetism powder, it is desirable to express the addition rate of MnBi magnetism powder with a weight ratio, and to make it or more into 1:9. Moreover, if there are too few these ratios, the output of the difficult signal of elimination aiming at forged prevention and rewriting will become small, and the probability judged to be a forged magnetic-recording medium also by the regular magnetic-recording medium containing MnBi magnetism powder will become high.
[0056] On the other hand, in order that magnetic powder other than MnBi magnetism powder may contribute to the reproduction output of a rewritable field (rewrite function), as for the addition rate of MnBi magnetism powder and this magnetic powder, it is desirable to express with a weight ratio and to carry out to 9:1 or less. Therefore, in order to keep good [balance] the reproduction output of the field which is not rewritable once it writes in a signal, and a rewritable field, it is desirable to set this ratio as the range of 9:1 to 1:9, and when especially this ratio is made into the range of 2:8 to 8:2, a property can be demonstrated with the most sufficient balance.
[0057] Moreover, when carrying out the laminating of the magnetic layer containing MnBi magnetism powder, and the magnetic layer containing the above-mentioned magnetic powder, respectively, it is desirable to set up magnetic layer thickness so that the ratio of the residual magnetic flux density of each magnetic layer may become 2:8 to about 8:2.
[0058] Even when [this] carrying out a laminating, the magnetic-recording medium in which the ratio of a residual magnetic flux density had the good property of the balance which can prevent forgery like the case where magnetic powder is mixed while maintaining the rewriting function at the time about of 2:8 to 8:2 is obtained.
[0059] Moreover, it is desirable to usually be referred to as about 2-30 micrometers as magnetic layer thickness, in applying to a magnetic card, and even when carrying out a laminating, it is desirable to set each magnetic layer thickness to about 1-20 micrometers, and to set the whole magnetic layer thickness to about 2-30 micrometers.
[0060] Moreover, when carrying out a laminating, whichever the magnetic layer containing MnBi magnetism powder and the magnetic layer containing the above-mentioned magnetic powder become [the upper layer or / lower layer], the feature of this invention is not spoiled.
[0061] moreover, it is also possible also by preparing the magnetic layer containing MnBi magnetism powder, and the magnetic layer containing the above-mentioned magnetic powder in both sides of a magnetic-recording medium, respectively to say nothing of the ability to demonstrate the effect of this invention, to have combined the magnetic layer of the above-mentioned composition arbitrarily, and to use it further
[0062] Moreover, if the shield layer which made permalloy powder and Sendust powder contain further is made to form in the front face of the magnetic layer which records this data, reading of data and rewriting will become difficulty further and security nature will improve further. Moreover, even if it forms various kinds of protective layers and concealment layers which are usually used for the magnetic card, it cannot be overemphasized that the feature of this invention is not spoiled.
[0063] Mixed distribution of these magnetic powder is carried out with a binder resin, the organic solvent, etc., a magnetic paint is prepared, and this is applied on a base and it dries, and it is produced according to a conventional method, for example, is produced [the magnetic-recording medium using this MnBi magnetism powder and other magnetic powder which is magnetic powder in which record, elimination, and rewriting are possible in the above-mentioned magnetic head forms a magnetic layer, and].
[0064] As a binder resin used here, each thing generally used for the magnetic-recording medium is used, for example, a vinyl chloride-vinyl acetate system copolymer, polyvinyl butyral resin, a fibrin system resin, a fluorine system resin, a polyurethane system resin, an isocyanate compound, a radiation-curing type resin, etc. are used.
[0065] In addition, if moisture exists as MnBi magnetism powder was already described, it corrodes and is easy to decompose, and corrosion and decomposition will become remarkable when especially moisture is acid. Then, although the above-mentioned binder resin is enough when distributing MnBi magnetism powder uniformly in a magnetic layer, chemical stability can be further raised by including a basic functional group further in the above-mentioned binder resin, when raising the stability over moisture further. As this basic functional group, an imine, an amine, an amide, thiourea, CHIOZO-RU, the ammonium salt, or the phosphonium compound is suitable, for example.
[0066] Moreover, it is also effective to add the additive which has a basic functional group as a means to include a basic functional group in a magnetic layer. An imine, an amine, an amide, thiourea, CHIOZO-RU, the ammonium salt, or the phosphonium compound is suitable like [the basic functional group included in this additive] the aforementioned binder resin.
[0067] Specifically A monomethylamine, an ethylamine, propylamine, an isopropylamine, A butylamine, an amyl amine, a hexylamine, a heptyl amine, an octyl amine, A nonyl amine, a desyl amine, a undecyl amine, a dodecyl amine, A tridecyl amine, a tetradecylamine, a pentadecyl amine, a cetyl amine, Aliphatic primary amines, such as a stearyl amine, a dimethylamine, a diethylamine, Aliphatic secondary amines, such as a dipropyl amine, diisopropylamine, a dibutyl amine, and diamylamine, It is used as aliphatic tertiary amines, such as a trimethylamine, a triethylamine, tripropylamine, tributylamine, a triamylamine, and tridodecylamine, and what has still more suitable aliphatic unsaturation amine, alicyclic amine, aromatic amine, etc. That which furthermore denaturalized coupling agents, such as Si, and aluminum, Ti, by various kinds of amines can be used as a suitable

thing.
[0068] Although chemical stability improves so that the addition of the additive containing such a basic functional group generally increases, if many [too], the flux density of a magnetic layer will fall. Then, although it is desirable to usually consider as about 1 - 15% by the weight ratio to magnetic powder, it is especially desirable to add about 2 to 10% of the weight as a large range of an effect on an anti-corrosion disposition, without reducing the flux density of a magnetic layer so much.
[0069] As an organic solvent, it is independent, or they are used by two or more sorts of organic solvents currently used widely conventionally [, such as toluene, a methyl ethyl ketone, a methyl isobutyl ketone, a cyclohexanone, a tetrahydrofuran, and ethyl acetate,], mixing. Moreover, it is still more desirable to use the solvent of non-polarity which it is desirable to use it after removing as much as possible as for the moisture dissolved in these organic solvents, and cannot dissolve water easily in the organic solvent for the reason mentioned above.
[0070] In addition, although addition use of various kinds of additives usually used, for example, a dispersant, lubricant, the antistatic agent, etc. may be carried out arbitrarily, if the acid matter exists, MnBi magnetism powder will deteriorate and it will come to burn into a magnetic paint. Therefore, as for the acid lubricant usually used for the magnetic-recording medium, it is desirable from the field of chemical stability to lessen an addition as much as possible.
[0071] It is desirable to make it the volume rate of the magnetic powder occupied in a magnetic layer become 5 - 60% as a content rate of both the magnetism powder with which MnBi magnetism powder and other magnetic powder were combined. In the case of the magnetic layer containing especially MnBi magnetism powder, by making this value into 5% or more, the output when making it a magnetic-recording medium becomes high, and corrosion resistance also improves simultaneously.
[0072] While the dispersibility of magnetic powder becomes good and the stacking tendency of magnetic powder becomes high by on the other hand making the volume rate of magnetic powder into 60% or less, the **** effect of chemical stability [a next door and] of the magnetic powder by the binder resin improves enough. Thus, the chemical stability which is the trouble peculiar to a paint film of having used this magnetic powder other than the occupied-volume rate in the inside of a paint film affecting magnetic properties and a recording characteristic like the usual magnetic-recording medium in the case of the magnetic layer containing MnBi magnetism powder is also affected.
[0073] Therefore, in order to obtain the paint film excellent not only in magnetic properties or a recording characteristic but chemical stability, it is desirable to make it the volume rate of magnetic powder become 5 - 60%, and when it considers as 20 - 50% especially, the most excellent property is acquired in the overall characteristics, such as magnetic properties and a recording characteristic.
[0074] Thus, mixed distribution of MnBi magnetism powder and the magnetic powder which consists of other magnetic powder which is magnetic powder in which record, elimination, and rewriting are possible by the magnetic head is carried out with a binder resin, the organic solvent, etc., a magnetic paint is prepared, this magnetic paint is applied by arbitrary application meanses on bases, such as polyester, and in case it dries and a magnetic layer is formed, after applying a magnetic paint on a base, it is desirable to perform magnetic field orientation in parallel to a magnetic layer side. As this magnetic field strength, about 1000-5000 Oes are desirable.
[0075] Moreover, although both the production methods of the above-mentioned magnetic-recording medium raise and state to an example the magnetic-recording medium which consists of a magnetic layer containing the magnetic powder in which record, elimination, and rewriting are possible by MnBi magnetism powder and the magnetic head, they do not change the production method fundamentally with the above-mentioned method by MnBi magnetism powder and the magnetic head in the magnetic-recording medium to which the laminating of the magnetic layer containing the magnetic powder in which record, elimination, and rewriting are possible was carried out.
[0076] Thus, when a magnetic layer is formed, the coercive force Hc, flux density Bm, and square shape Br/Bm change with the kinds and addition rates of magnetic powder other than MnBi magnetism powder, when making both the magnetic powder that has the coercive force which impressed and measured the magnetic field of 16kOe(s) in MnBi magnetism powder and 300K in the range of 300Oe(s) to 8000Oe(s) contain.
[0077] Moreover, in carrying out the laminating of the magnetic layer containing MnBi magnetism powder, and the magnetic layer which contains the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head, coercive force Hc, flux density Bm, and square shape Br/Bm change with the kind of magnetic layer which carries out a laminating, or ratios of the thickness.
[0078] However, when these values impressed and measure the magnetic field of 16kOe(s) in the temperature of 300K by any case, coercive force becomes the range of 300-12000Oe, and flux density becomes the range of 500-3000G, and square shape Br/Bm serves as the range of 0.60-0.95.
[0079] After applying so that it may be set to 2-30 micrometers as thickness of a magnetic layer in applying the magnetic-recording medium of this invention to magnetic cards, such as PURIPE-DOKA-DO, and a magnetic commuter pass, a magnetic ticket, it is desirable to form concealment layers, such as a protective layer and a color layer, in the front face further, so that it may become the thickness of 0.5-10 micrometers.
[0080] Moreover, if the hydrophobic layer which consists of a water-repellent resin further is prepared in the front face of the magnetic layer containing MnBi magnetism powder, chemical stability and chemical resistance will improve further. As this water-repellent resin, a polyvinylidene chloride resin, an ethylene-vinyl alcohol system polymer, a fluorine system resin or a fluoride vinylidene system resin, an acrylic resin, etc. can be used. Moreover, as thickness of this hydrophobic layer, 0.5-5 micrometers is desirable, sufficient water-repellent effect can be acquired, by being referred to as 0.5 micrometers or more, a

spacing loss becomes small by on the other hand being referred to as 5 micrometers or less, and the output when making it a magnetic-recording medium improves.
[0081] this invention can acquire the same property also in the magnetic-recording medium to which the laminating of the magnetic layer containing MnBi magnetism powder and the magnetic layer which contains other magnetic powder which is magnetic powder in which record, elimination, and rewriting are possible by the magnetic head was carried out also about the magnetic-recording medium which made both MnBi magnetism powder and other magnetic powder which is magnetic powder in which record, elimination, and rewriting are possible in the magnetic head contain in a magnetic layer. However, since the number of times by which the direction of MnBi magnetism powder and the magnetic-recording medium which made both the magnetic powder in which record, elimination, and rewriting are possible contain by the magnetic head applies a magnetic layer into a magnetic layer decreases, a manufacturing cost becomes low and a practical merit is large.
[0082] Thus, record is performed after the produced magnetic-recording medium is initialized. Once the record method of data records a signal, they differ by the record method to the field (a write-once function, lead-only function) where rewriting is difficult, and the record method to the field (rewrite function) which can perform rewriting of a signal arbitrarily.
[0083] Once it records a signal, the record method to the field where rewriting is difficult can record data using the encoder and the magnetic card reader writer for magnetic cards, when not changing especially with the usual magnetic-recording method, for example, applying to a magnetic card. Once the magnetic layer containing MnBi magnetism powder records data unlike other magnetic-recording media, elimination and rewriting of subsequent data will become very difficult.
[0084] In recording a signal on the field which can perform rewriting of a signal arbitrarily on the other hand, a magnetic field is first impressed to this field, and it magnetizes this field uniformly. Although it is the usual elimination operation and the same operation and can attain by impressing a direct-current magnetic field and being magnetized, using the magnetic head as the impression method of this magnetic field, the same effect is acquired even if it magnetizes this field uniformly using a permanent magnet. Moreover, as impression magnetic field strength at this time, even if too strong, although there are especially no problem and bird clapper, it is desirable [a bird clapper] to consider as the magnetic field strength of 1000 or more Oes. Data are recorded on this magnetized field by the usual method.
[0085] Thus, the recorded data can rewrite data easily like the usual magnetic-recording medium. In order for MnBi magnetism powder to be magnetized by the first magnetic field impression operation and to record data after that, even if it impresses a magnetic field from the magnetic head, magnetization of MnBi magnetism powder does not change but stops because, contributing to an output. Therefore, MnBi magnetism powder will not affect reading of data.
[0086] Next, the case where the magnetic-recording medium of this invention is applied to magnetic cards, such as PURIPE-DOKA-DO, and a magnetic commuter pass, a magnetic ticket, is mentioned as an example, and the composition and its record reproduction method of a magnetic-recording medium are explained in detail.
[0087] Although various kinds of examples are given in an example and the production method of a card is explained in detail, that to which the laminating of the magnetic layer to which coercive force contains MnBi magnetism powder in a lower layer, and contains the barium-ferrite magnetism powder of 2850Oe(s) in the upper layer as a card was carried out is mentioned as an example, and the record reproduction method to this card is explained.
[0088] Also in the magnetic-recording medium by which the record reproduction method described below made both MnBi magnetism powder and other magnetic powder which is magnetic powder in which record, elimination, and rewriting are possible in the magnetic head contain, there is no change fundamentally.
[0089] <Record of the signal which can do rewriting arbitrarily> <<rewrite function>>
After cooling the magnetic-recording medium of composition of having carried out the laminating of the magnetic layer to which coercive force contains MnBi magnetism powder in a lower layer, and contains the barium-ferrite magnetism powder of 2850Oe(s) in the upper layer at low temperature and changing into a demagnetization state, a direct-current magnetic field is first impressed to the fields where a magnetic layer is arbitrary, and it is magnetized.
[0090] It records by the after that usual method. The data recorded by this method become rewritable [data] like the usual magnetic-recording medium. Because, if a direct-current magnetic field is impressed after cooling a magnetic-recording medium at low temperature and changing into a demagnetization state, even if it impresses a magnetic field from the magnetic head in order to record subsequent data since the MnBi magnetism powder contained in a lower layer is magnetized and coercive force becomes very large, magnetization of MnBi magnetism powder will hardly change and data will not be recorded on the MnBi magnetism powder contained in a lower layer. Data are recorded by the magnetic field from the magnetic head on the barium-ferrite magnetism powder contained in the upper layer on the other hand, and data can be arbitrarily rewritten to it.
[0091] In this field, when applying to for example, PURIPE-DOKA-DO, the balance of the card of recording data with the need of rewriting data at every use etc. is desirable.
[0092] <Record of a signal with difficult rewriting and elimination which are after that once postscript writing is made and it writes in> <<write-once function>>
Postscript writing can do the state where the magnetic-recording medium of composition of having mentioned above was cooled and demagnetized at low temperature, and once it writes in, subsequent rewriting and elimination are in the difficult state. Record of the data to this field is recorded by the usual method. The data recorded by this method are recorded also on the upper barium-ferrite magnetism powder by lower layer MnBi magnetism powder.
[0093] Next, if other data are piled up and recorded in order to rewrite data, since the data recorded later will be recorded only on barium-ferrite magnetism powder, the data currently previously recorded on MnBi magnetism powder and two kinds of data

recorded on barium-ferrite magnetism powder afterwards are intermingled, and an error will be caused if this magnetic-recording medium is reproduced. Therefore, data can be written in this field only at once.

[0094] Operation which carries out marking magnetically is desirable instead of making a punch hole and showing the use amount of money as data recorded on this field, in applying, for example to PURIPE-DOKA-DO. Although the alteration returned to an intact state by plugging up a hole is possible in the case of a punch hole, if marking is magnetically performed by such method, since it will become very difficult to rewrite or eliminate this marking, alteration and forgery can be prevented.

[0095] < -- it writes in beforehand -- having -- **** -- rewriting -- record> of a signal with difficult elimination -- <<lead-only function>>

After cooling the magnetic-recording medium of composition of having mentioned above at low temperature and changing into a demagnetization state, data are recorded by the usual method. Next, a direct current or alternating field is impressed to the field which recorded this data, and it is magnetized.

[0096] Although the data currently recorded on the upper barium-ferrite magnetism powder will be eliminated by this magnetization processing, the data currently recorded on lower layer MnBi magnetism powder are not eliminated. Therefore, even if it reproduces in this state, the data currently recorded on MnBi magnetism powder are reproduced normally.

[0097] After recording data, this demagnetization processing may be performed immediately or may be performed before reproduction of data. By the magnetic-recording medium which does not contain MnBi magnetism powder, since data will be eliminated by the above-mentioned processing and a reproduction error is caused, the counterfeit card which will not contain MnBi magnetism powder even if the full copy of the data is carried out can be eliminated.

[0098] Moreover, although data are reproducible even if it does not perform this magnetization processing, it becomes possible by performing magnetization processing to eliminate the counterfeit card which does not contain MnBi magnetism powder by the magnetic means.

[0099] As data recorded on this field, when applying, for example to PURIPE-DOKA-DO, the time of the amount of money of the card, an issue place, and the date of issue of there being no need of rewriting or writing in beforehand the data which must not be rewritten at the time of card issue etc. is desirable.

[0100] Furthermore, the information about the field which has each aforementioned function to the field where rewriting different from the aforementioned field is difficult for the specific field of a magnetic-recording medium, For example, by recording the truck position etc. beforehand, and rewriting pinpointing a difficult field and a rewritable field and carrying out record reproduction according to this information It also becomes possible to make it the record position of the field where rewriting is difficult, and each rewritable field change altogether with cards, and very powerful security is obtained.

[0101] Next, the reproduction method of data is explained. Once it also writes in the signal which can do rewriting arbitrarily, the reproduction method cannot change a signal with subsequent difficult rewriting elimination as fundamentally as the reproduction method of the usual magnetic-recording medium, either, but it can be reproduced using the magnetic head.

[0102] However, as mentioned above, once it writes in, among signals with subsequent difficult rewriting elimination, before reproduction, a lead-only signal will impress a magnetic field, and will magnetize and eliminate. Since the data currently recorded on the counterfeit card which does not contain MnBi magnetism powder by this magnetization processing will be eliminated, they cause a reproduction error.

[0103] This magnetization processing can be performed also by impressing a magnetic field with a permanent magnet, although it can carry out easily by impressing a direct current or alternating field to the magnetic head.

[0104] Usually, in order to spread a new magnetic-recording medium in a commercial scene, it is necessary to also newly develop the recording device and reader for using the magnetic-recording medium first, and to spread these equipments. However, it is very difficult to already replace all of these equipments in the present condition that record and the reader have spread, like a magnetic card to all the corners in the world.

[0105] The record and the reader which are only record of data, the kind of magnetic field added at the time of reproduction, and the combination of the sequence of adding a magnetic field, and have spread fundamentally now can be used for the magnetic-recording medium of this invention as it is, and it can make a rewrite function, a write-once function, and a lead-only function discover. Impact is so large that it plans that the equipments of this present condition are used as they are, and powerful security can be demonstrated and it is not found from a practical standpoint.

[0106]

[Example] Hereafter, an example is given and explained about the magnetic-recording medium and its record method of this invention.

Weighing capacity of Mn powder and Bi powder which were ground so that the production>> grain size of example 1 <<MnBi magnetism powder might become 200 meshes was carried out so that Mn and Bi might be set to 55:45 by the mole ratio, and it mixed enough using the ball mill.

[0107] Next, a pressurization press machine is used for such mixture, and it is 2 3t/cm. It cast by the pressure with a diameter [of 20mm], and a height of 10mm in the shape of a pillar. After putting this molding object into the aluminum container of a direct vent system and lengthening to a vacuum, 0.5 atmospheric pressure of nitrogen gas was introduced. Next, this container was put into the electric furnace and it heat-treated for ten days at the temperature of 270 degrees C. It took out after heat treatment and in MnBi ingot air, the mortar ground lightly, and magnetic properties were measured. The coercive force which impressed and measured the magnetic field of maximum magnetic field 16kOe by 300K was 840Oe(s), and the amount of magnetization was 53.6 emu/g.

[0108] Next, the above-mentioned MnBi powder which carried out coarse grinding was pulverized using the planet ball mill. The ball mill pot of 1000 cc of content volume was filled up with JIRUKONIABO-RU with a diameter of 3mm so that one third of content volume might be occupied. Into this, 500g of toluene was put in as 500g of MnBi powder which carried out coarse grinding, and a solvent, and it ground by rotational frequency 150rpm for 4 hours. Magnetic properties were measured, after taking out the obtained MnBi magnetism powder and evaporating toluene. The coercive force and the amounts of magnetization which impressed and measured the magnetic field of maximum magnetic field 16kOe by 300K were 8600Oe(s) and 39.2 emu/g, respectively.
[0109] Stabilizing treatment was performed to the MnBi magnetism powder obtained by the aforementioned method by the following methods. MnBi magnetism powder was taken out in the state where it dipped in toluene, it moved to the heat treatment container, and the about 2 between vacuum drying was carried out at the room temperature. Next, 1 atmospheric pressure of nitrogen gas containing 1000 ppm of oxygen was introduced putting into the same container, and heat treatment was performed in the temperature of 40 degrees C for 15 hours.
[0110] Succeedingly, as heat treatment of the 2nd phase, after having introduced 0.5 atmospheric pressure of nitrogen gas after carrying out vacuum length of the oxygen mixed gas with which the container is filled up and removing it, and raising temperature to 330 degrees C, it heat-treated at this temperature for 2 hours.
[0111] The coercive force and the amounts of magnetization which the mean particle diameter of the MnBi magnetism powder finally obtained is 1.8 micrometers, and impressed and measured the magnetic field of maximum magnetic field 16kOe by 300K by the above-mentioned method were 8500Oe(s) and 46.3 emu/g, respectively.
[0112] Production>> of <<magnetism paint The following constituents were prepared using the MnBi magnetism powder and barium-ferrite magnetism powder which were produced by the above-mentioned method as magnetic powder. As barium-ferrite magnetism powder, the thing of 0.9 micrometers of average grain size, coercive force 1750Oe (it is the same the value when impressing the magnetic field of 16kOe(s) by 300K and the following), and saturation magnetization 53.3 emu/g was used.
[0113]
MnBi magnetism powder (Hc:8500Oe) 10 weight sections Barium-ferrite magnetism powder (0.9 micrometers of average grain size, ** 90 ** magnetism 1750Oe, saturation magnetization 53.3 emu/g)
VAGH (; made from UCC vinyl chloride-vinyl acetate-BINIRUA 25 ** RUKO-RU copolymer)
methyl isobutyl ketone 50 ** toluene 50 ** -- it applied, impressing the longitudinal orientation magnetic field of 2000Oe(s) on a PET base film with a thickness of 190 micrometers so that the thickness after dryness may be set to 15 micrometers after distributing this constituent enough with a ball mill
[0114] In composition of the magnetic paint in example 2 example 1, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 20 weight sections and 80 weight sections from 10 weight sections and 90 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0115] In composition of the magnetic paint in example 3 example 1, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 30 weight sections and 70 weight sections from 10 weight sections and 90 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0116] In composition of the magnetic paint in example 4 example 1, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 40 weight sections and 60 weight sections from 10 weight sections and 90 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0117] In composition of the magnetic paint in example 5 example 1, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 50 weight sections and 50 weight sections from 10 weight sections and 90 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0118] In composition of the magnetic paint in example 6 example 1, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 60 weight sections and 40 weight sections from 10 weight sections and 90 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0119] In composition of the magnetic paint in example 7 example 1, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 70 weight sections and 30 weight sections from 10 weight sections and 90 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0120] In composition of the magnetic paint in example 8 example 1, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 80 weight sections and 20 weight sections from 10 weight sections and 90 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0121] In composition of the magnetic paint in example 9 example 1, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 90 weight sections and 10 weight sections from 10 weight sections and 90 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0122] In composition of the magnetic paint in example 10 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the barium-ferrite magnetism powder of 0.9 micrometers of average grain size, coercive force 2850Oe, and saturation magnetization 53.4 emu/g. And except having made the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0123] In composition of the magnetic paint in example 11 example 10, except having changed the addition rate of MnBi

magnetism powder and barium-ferrite magnetism powder into 50 weight sections and 50 weight sections from 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 10 and the paint film was produced.
[0124] In composition of the magnetic paint in example 12 example 10, except having changed the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 60 weight sections and 40 weight sections from 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 10 and the paint film was produced.
[0125] In composition of the magnetic paint in example 13 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the cobalt content iron-oxide magnetism powder of 0.4 micrometers of average grain size, coercive force 650Oe, and saturation magnetization 74.5 emu/g. And except having made the addition rate of MnBi magnetism powder and cobalt content iron-oxide magnetism powder into 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0126] In composition of the magnetic paint in example 14 example 13, except having changed the addition rate of MnBi magnetism powder and cobalt content iron-oxide magnetism powder into 50 weight sections and 50 weight sections from 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 13 and the paint film was produced.
[0127] In composition of the magnetic paint in example 15 example 13, except having changed the addition rate of MnBi magnetism powder and cobalt content iron-oxide magnetism powder into 60 weight sections and 40 weight sections from 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 13 and the paint film was produced.
[0128] In composition of the magnetic paint in example 16 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the gamma-acid-ized ferromagnetism powder of 0.4 micrometers of average grain size, coercive force 340Oe, and saturation magnetization 74.2 emu/g. And except having made the addition rate of MnBi magnetism powder and gamma-acid-ized ferromagnetism powder into 50 weight sections and 50 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0129] In composition of the magnetic paint in example 17 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the magnetite magnetism powder of 0.4 micrometers of average grain size, coercive force 360Oe, and saturation magnetization 77.1 emu/g. And except having made the addition rate of MnBi magnetism powder and magnetite magnetism powder into 50 weight sections and 50 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0130] In composition of the magnetic paint in example 18 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the strontium-ferrite magnetism powder of 0.9 micrometers of average grain size, coercive force 3100Oe, and saturation magnetization 54.1 emu/g. And except having made the addition rate of MnBi magnetism powder and strontium-ferrite magnetism powder into 50 weight sections and 50 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0131] In composition of the magnetic paint in example 19 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the barium-ferrite magnetism powder of 0.3 micrometers of average grain size, coercive force 5500Oe, and saturation magnetization 43.1 emu/g. And except having made the addition rate of MnBi magnetism powder and barium-ferrite magnetism powder into 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0132] In composition of the magnetic paint in example 20 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the metal magnetism powder of 0.3 micrometers of average grain size, coercive force 1540Oe, and saturation magnetization 135.3 emu/g. And except having made the addition rate of MnBi magnetism powder and metal magnetism powder into 50 weight sections and 50 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0133] In composition of the magnetic paint in example 21 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the chromium-dioxide magnetism powder of 0.3 micrometers of average grain size, coercive force 720Oe, and saturation magnetization 73.8 emu/g. And except having made the addition rate of MnBi magnetism powder and chromium-dioxide magnetism powder into 50 weight sections and 50 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0134] In composition of the magnetic paint in example 22 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the samarium cobalt magnetism powder of 3.5 micrometers of average grain size, coercive force 7800Oe, and saturation magnetization 40.9 emu/g. And except having made the addition rate of MnBi magnetism powder and samarium cobalt magnetism powder into 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the

example 1 and the paint film was produced.
[0135] In composition of the magnetic paint in example 23 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the neodium iron boron magnetism powder of 3.9 micrometers of average grain size, coercive force 7400Oe, and saturation magnetization 110 emu/g. And except having made the addition rate of MnBi magnetism powder and neodium iron boron magnetism powder into 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0136] Production [of an example 24 <<magnetism paint]>>
<Production of the magnetic paint for lower layers> The MnBi magnetism powder produced by the aforementioned method as magnetic powder was used, it distributed enough using the ball mill by the following composition, and the magnetic paint was produced.
MnBi magnetism powder (Hc:8500Oe) The 100 weight sections VAGH (; made from UCC vinyl chloride-vinyl acetate-BINIRUA 25 ** RUKO-RU copolymer)
Methyl isobutyl ketone 50 ** toluene 50 ** [0137] <Production of the magnetic paint for the upper layers> As magnetic powder, the barium-ferrite magnetism powder of 0.9 micrometers of average grain size, coercive force 2850Oe, and saturation magnetization 53.4 emu/g was used, the following constituents distributed enough using the ball mill, and the magnetic paint was produced.
Barium-ferrite magnetism powder (Hc:2850Oe) The 100 weight sections VAGH (; made from UCC vinyl chloride-vinyl acetate-BINIRUA 25 ** RUKO-RU copolymer)
Methyl isobutyl ketone 50 ** toluene 50 ** [0138] Production>> of <<magnetism paint film It applied impressing the longitudinal orientation magnetic field of 3000Oe(s) first, so that the thickness after dryness may be set to 15 micrometers on a PET base film with a thickness of 190 micrometers in the above-mentioned magnetic paint for lower layers. Next, it applied impressing the longitudinal orientation magnetic field of 3000Oe(s) to this lower layer magnetic layer front face similarly so that the thickness after drying the above-mentioned magnetic paint for the upper layers may be set to 10 micrometers, and the magnetic paint film was produced.
[0139] In example 25 example 24, the magnetic paint for the upper layers is used as a magnetic paint for lower layers. After applying impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers, The magnetic paint film was produced like the example 24 except having applied impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers using the magnetic paint for lower layers as a magnetic paint for the upper layers, and having produced the magnetic paint film.
[0140] In example 26 example 24, as a magnetic paint for the upper layers, it replaced with barium-ferrite magnetism powder, and the magnetic paint film was produced like the example 24 except having used the magnetic paint which carried out the amount use of said and prepared Co content iron-oxide magnetism powder of coercive force 650Oe.
[0141] The magnetic paint which replaced with MnBi magnetism powder, carried out the amount use of said and prepared Co content iron-oxide magnetism powder of coercive force 650Oe as a magnetic paint for lower layers in example 27 example 24 After applying impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers, The magnetic paint film was produced like the example 24 except having applied impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers using the magnetic paint for lower layers which used the MnBi magnetism powder of an example 24 as a magnetic paint for the upper layers, and having produced the magnetic paint film.
[0142] Production [of an example 28 <<magnetism paint]>>
<Production of the magnetic paint for lower layers> As magnetic powder, the barium-ferrite magnetism powder of 0.9 micrometers of average grain size, coercive force 2850Oe, and saturation magnetization 53.4 emu/g was used, the following constituents distributed enough using the ball mill, and the magnetic paint was produced.
Barium-ferrite magnetism powder (Hc:2850Oe) The 100 weight sections VAGH (; made from UCC vinyl chloride-vinyl acetate-BINIRUA 25 ** RUKO-RU copolymer)
Methyl isobutyl ketone 50 ** toluene 50 ** [0143] <Production of the magnetic paint for the upper layers> The MnBi magnetism powder produced by the aforementioned method as magnetic powder and the cobalt content iron-oxide magnetism powder of 0.4 micrometers of grain size used in the example 13, coercive force 650Oe, and saturation magnetization 74.5 emu/g were used, it distributed enough using the ball mill by the following composition, and the magnetic paint was produced.
MnBi magnetism powder (Hc:8500Oe) 50 weight sections Cobalt content iron-oxide magnetism powder (Hc:650Oe) 50 ** VAGH (; made from UCC vinyl chloride-vinyl acetate-BINIRUA 25 ** RUKO-RU copolymer)
Methyl isobutyl ketone 50 ** toluene 50 ** [0144] Production>> of <<magnetism paint film It applied impressing the longitudinal orientation magnetic field of 3000Oe(s) first, so that the thickness after dryness may be set to 15 micrometers on a PET base film with a thickness of 190 micrometers in the above-mentioned magnetic paint for lower layers. Next, it applied impressing the longitudinal orientation magnetic field of 3000Oe(s) to this lower layer magnetic layer front face similarly so that the thickness after drying the above-mentioned magnetic paint for the upper layers may be set to 10 micrometers, and the magnetic paint film was produced.
[0145] The magnetic paint for lower layers which used the MnBi magnetism powder in example of comparison 1 example 24 was used, and it applied, impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness

may be set to 15 micrometers, and the magnetic paint film was produced.
[0146] In composition of the magnetic paint in example of comparison 2 example 1, MnBi magnetism powder was excluded, except having used only barium-ferrite magnetism powder, the magnetic paint was prepared like the example 1, and it applied, impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers, and the magnetic paint film was produced.
[0147] The magnetic paint for the upper layers which used the barium-ferrite magnetism powder in example of comparison 3 example 24 was used, and it applied, impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers, and the magnetic paint film was produced.
[0148] In composition of the magnetic paint in example of comparison 4 example 1, it replaced with the magnetic powder used in the example 1, and except having used only the cobalt content iron-oxide magnetism powder of coercive force 650Oe, the magnetic paint was prepared like the example 1, and it applied, impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers, and the magnetic paint film was produced.
[0149] In composition of the magnetic paint in example of comparison 5 example 1, except having excluded MnBi magnetism powder, having replaced with the barium-ferrite magnetism powder of coercive force 1750Oe, and having used the barium-ferrite magnetism powder of coercive force 5500Oe, the magnetic paint was prepared like the example 1, and it applied, impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers, and the magnetic paint film was produced.
[0150] In composition of the magnetic paint in example of comparison 6 example 1, it replaced with the magnetic powder used in the example 1, and except having used only the samarium cobalt magnetism powder of coercive force 7800Oe, the magnetic paint was prepared like the example 1, and it applied, impressing the longitudinal orientation magnetic field of 3000Oe(s) so that the thickness after dryness may be set to 15 micrometers, and the magnetic paint film was produced.
[0151] In production of the magnetic paint in example of comparison 7 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the gamma-acid-ized ferromagnetism powder of 0.4 micrometers of average grain size, coercive force 280Oe, and saturation magnetization 75.4 emu/g. And except having made the addition rate of MnBi magnetism powder and gamma-acid-ized ferromagnetism powder into 50 weight sections and 50 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0152] In production of the magnetic paint in example of comparison 8 example 1 magnetic powder 0.9 micrometers of average grain size, From the barium-ferrite magnetism powder of coercive force 1750Oe and saturation magnetization 53.3 emu/g It changes into the neodium iron boron magnetism powder of 3.2 micrometers of average grain size, coercive force 8600Oe, and saturation magnetization 105 emu/g. And except having made the addition rate of MnBi magnetism powder and neodium iron boron magnetism powder into 40 weight sections and 60 weight sections, respectively, the magnetic paint was prepared like the example 1 and the paint film was produced.
[0153] thus, the result which summarized the magnetic powder of a multilayer paint film, and magnetic layer thickness for the result which summarized the magnetic powder of the produced monolayer paint film, and the addition rate in Table 1 and 2 -- Table 3 -- moreover, the result which measured square shape Br/Bm of the coercive force Hc which impressed and measured the magnetic field of 16kOe(s) in 300K about these paint films, flux density Bm, and a longitudinal direction is shown in Table 4 and 5
[0154] in addition, in this example, as magnetic powder used with MnBi magnetism powder Gamma-acid-ized ferromagnetism powder, magnetite magnetism powder, cobalt content iron-oxide magnetism powder, Although chromium-dioxide magnetism powder, metal magnetism powder, barium-ferrite magnetism powder, strontium-ferrite magnetism powder, samarium cobalt magnetism powder, and neodium iron boron magnetism powder were mentioned as the example and explained In addition, by the magnetic head, it is usable in all the magnetism powder in which record, elimination, and rewriting are possible, and the coercive force which impressed and measured the magnetic field of 16kOe(s) in 300K can use suitably the magnetic powder in the range of 300Oe(s) to 8000Oe(s).
[0155] That is, once it records MnBi magnetism powder, subsequent elimination and subsequent rewriting have the difficult feature, and it cannot be overemphasized by it irrespective of the size of coercive force as magnetic powder both added that magnetic powder, such as nitride magnetism powder, such as the magnetic powder in which record, elimination, and rewriting are possible, for example, iron, and cobalt, and carbide magnetism powder, is also usable.
[0156] Although the thing of the still more fundamental composition as composition of a magnetic-recording medium in this example was explained, even if it adds various kinds of additives in a magnetic paint, the feature of this invention is not spoiled at all. Moreover, when applying this magnetic-recording medium to magnetic cards, such as PURIPE-DOKA-DO, and a magnetic commuter pass, a magnetic ticket, it is desirable to form concealment layers, such as various kinds of protective layers and a color layer, in the front face of a magnetic layer. It cannot be overemphasized that it is not what spoils the feature of this invention in any way even if it forms such a protective layer and a concealment layer, either.
[0157]

表1　単層塗膜の磁性粉末、添加割合

	使用磁性粉末		重量添加割合
	A	B	(A／B)
実施例　1	MnBi	Ba－フェライト(Hc:1750Oe)	１０／９０
〃　2	MnBi	Ba－フェライト(Hc:1750Oe)	２０／８０
〃　3	MnBi	Ba－フェライト(Hc:1750Oe)	３０／７０
〃　4	MnBi	Ba－フェライト(Hc:1750Oe)	４０／６０
〃　5	MnBi	Ba－フェライト(Hc:1750Oe)	５０／５０
〃　6	MnBi	Ba－フェライト(Hc:1750Oe)	６０／４０
〃　7	MnBi	Ba－フェライト(Hc:1750Oe)	７０／３０
〃　8	MnBi	Ba－フェライト(Hc:1750Oe)	８０／２０
〃　9	MnBi	Ba－フェライト(Hc:1750Oe)	９０／１０
〃　１０	MnBi	Ba－フェライト(Hc:2850Oe)	４０／６０
〃　１１	MnBi	Ba－フェライト(Hc:2850Oe)	５０／５０
〃　１２	MnBi	Ba－フェライト(Hc:2850Oe)	６０／４０
〃　１３	MnBi	Co含有酸化鉄(Hc:650 Oe)	４０／６０
〃　１４	MnBi	Co含有酸化鉄(Hc:650 Oe)	５０／５０
〃　１５	MnBi	Co含有酸化鉄(Hc:650 Oe)	６０／４０
〃　１６	MnBi	ガンマ酸化鉄(Hc:340 Oe)	５０／５０
〃　１７	MnBi	マグネタイト(Hc:360 Oe)	５０／５０
〃　１８	MnBi	Sr－フェライト(Hc:3100Oe)	５０／５０
〃　１９	MnBi	Ba－フェライト(Hc:5500Oe)	４０／６０
〃　２０	MnBi	メタル(Hc:1540Oe)	５０／５０

[0158]

表2　単層塗膜の磁性粉末、添加割合

	使用磁性粉末		重量添加割合
	A	B	(A／B)
実施例２１	MnBi	CrO_2 (Hc:720Oe)	５０／５０
〃　２２	MnBi	SmCo(Hc:7800Oe)	４０／６０
〃　２３	MnBi	NdFeB(74000e)	４０／６０
比較例　1	MnBi	――――――	１００／０
〃　2	――	Ba－フェライト(Hc:1750Oe)	０／１００
〃　3	――	Ba－フェライト(Hc:2850Oe)	０／１００
〃　4	――	Co含有酸化鉄(Hc:650 Oe)	０／１００
〃　5	――	Ba－フェライト(Hc:5500Oe)	０／１００
〃　6	――	SmCo(Hc:7800Oe)	０／１００
〃　7	MnBi	ガンマ酸化鉄(Hc:280 Oe)	５０／５０
〃　8	MnBi	NdFeB(Hc:8600 Oe)	４０／６０

[0159]

表3　多層塗膜の磁性粉末、磁性層厚さ

	上層の塗膜		下層の塗膜	
	使用磁性粉末	磁性層厚さ（μm）	使用磁性粉末	磁性層厚さ（μm）
実施例２４	Ba－フェライト（Hc:2850Oe）	10	MnBi	15
〃　２５	MnBi	15	Ba－フェライト（Hc:2850Oe）	15
〃　２６	Co含有酸化鉄（Hc:650Oe）	10	MnBi	15
〃　２７	MnBi	15	Co含有酸化鉄（Hc:650Oe）	15
〃　２８	MnBi Co含有酸化鉄（Hc:650 Oe）	15	Ba－フェライト（Hc:2850 Oe）	15

[0160]

表4　単層および多層塗膜の磁気特性

	保磁力 Hc（Oe）	磁束密度 Bm（G）	角形 Br／Bm
実施例　１	１７７０	１１２０	0.８７
〃　２	１７８０	１１３０	0.８７
〃　３	１８１０	１０９０	0.８８
〃　４	１８４０	１１１０	0.８６
〃　５	２０３０	１０７０	0.８６
〃　６	３２２０	１０９０	0.８７
〃　７	７０９０	１０３０	0.８７
〃　８	８９６０	１０８０	0.８５
〃　９	１０２９０	１１７０	0.８６
〃　１０	２８９０	１３１０	0.８５
〃　１１	３７１０	１２４０	0.８４
〃　１２	７７４０	１２９０	0.８４
〃　１３	６９０	１３８０	0.７６
〃　１４	８８０	１２５０	0.７５
〃　１５	２４５０	１１７０	0.７３
〃　１６	５１０	１３１０	0.７４
〃　１７	５２０	１３５０	0.７４
〃　１８	４６２０	１０９０	0.７６
〃　１９	５７８０	９７０	0.８８
〃　２０	２１００	１８８０	0.８０
〃　２１	９６０	１１９０	0.７９
〃　２２	８６００	９３０	0.８５

[0161]

表5 単層および多層塗膜の磁気特性

	保磁力 Hc (Oe)	磁束密度 Bm (G)	角形 Br／Bm
実施例23	8500	1790	0.86
〃 24	7350	1340	0.86
〃 25	3380	1410	0.86
〃 26	2200	1160	0.83
〃 27	810	1310	0.83
〃 28	1680	1180	0.85
比較例 1	12600	1350	0.85
〃 2	1760	1110	0.88
〃 3	2730	1250	0.86
〃 4	640	1400	0.83
〃 5	5480	990	0.88
〃 6	7880	740	0.85
〃 7	480	1340	0.75
〃 8	10200	1430	0.88

[0162] The paint film of production of an example 29 <<magnetic card, record reproduction method>> each example, and the example of comparison was produced, and the magnetic card was produced. The magnetic card produced the paint film of each example and the example of comparison on the PET base film with a thickness of 190 micrometers, and pierced and produced it in the configuration of a magnetic card.
[0163] It cooled by dipping these magnetic cards into liquid nitrogen first, and after this, promptly, the alternating current magnetic field of 1000Oe(s) was impressed, and was demagnetized and initialized.
[0164] Once it recorded a signal, in order that rewriting might investigate quantitatively the difficult difficulty [a field (a write-once function lead-only function)] of rewriting, and the ease of rewriting of a field (rewrite function) which can perform rewriting of a signal arbitrarily as the record reproduction method of a signal, it investigated by the method as shown below.
[0165] Using the magnetic card reader writer (CRSmade from Sanwa new tech- 700), record current was made into 200mA and recording density recorded the square wave of 210FCI(s) and 420FCI(s). Using the same magnetic card reader writer, reproduction of a signal also made it go via a band pass filter, incorporated the signal from the magnetic head in the oscilloscope, and asked for the reproduction output of 210FCI and 420FCI(s) from the wave amplitude of an oscilloscope.
[0166] once it records a signal -- as the field (field A) where rewriting is difficult -- first -- the upper part portion of the magnetic layer of a magnetic card -- the signal of recording density 420FCI -- recording -- a reproduction output -- asking -- this value -- a1 ** -- it carried out Next, it asks for the reproduction output of the signal of 420FCI(s) which are the signals which recorded the signal of recording density 210FCI in piles on the same truck, and were recorded before again, and is this value a2 It carried out. This a1 a2 to a value It asked for the ratio of a value and considered as the parameter of the difficulty of rewriting. This a2 / a1 It remains without eliminating the signal recorded before, even if it rewrites so that a value is large, and it is shown that rewriting is difficult.
[0167] Next, the same magnetic card reader writer was used as a field (field B) which can perform rewriting of a signal arbitrarily, and direct-current demagnetization of the lower part portion of a magnetic card was carried out. Current value at this time was also made into the same 200mA as the time of record. On the same truck which carried out direct-current demagnetization, the signal of recording density 420FCI is recorded first, and it asks for a reproduction output, and is this value b1 It carried out. Next, the signal of recording density 210FCI is recorded in piles, and it asks for the reproduction output of the signal of 210FCI, and is b2. It carried out. This b1 b2 to a value It asked for the ratio of a value and considered as the parameter of the ease of rewriting. When this value is 100%, having been completely rewritten by the signal which the signal recorded before recorded later is shown. Moreover, it investigated also about the case where used the permanent magnet and a magnetic field is impressed, instead of carrying out direct-current demagnetization, using the magnetic head as the impression method of the magnetic field before recording a signal on Field B.
[0168] the difficulty of rewriting is shown about the magnetic card of each example and the example of comparison (a2/a1) -- and the ease of rewriting -- being shown (b2 / b1) -- the result searched for is shown in Table 6 or 10
[0169]

表6　磁気カードの再生出力

	出力(a_1) (420FCI)	a_2(420FCI)/a_1(420FCI) (%)
		領域A 420FCI を記録後、210FCIを重ね記録
実施例 1	112	8
〃 2	106	14
〃 3	107	20
〃 4	102	25
〃 5	100	32
〃 6	98	43
〃 7	99	47
〃 8	103	54
〃 9	110	63
〃 10	105	24
〃 11	101	31
〃 12	98	41
〃 13	95	33
〃 14	96	40
〃 15	95	48
〃 16	94	39
〃 17	94	37
〃 18	102	30
〃 19	96	32
〃 20	119	35

[0170]

表7　磁気カードの再生出力

	出力(a_1) (420FCI)	a_2(420FCI)/a_1(420FCI) (%)
		領域A 420FCI を記録後、210FCIを重ね記録
実施例21	94	37
〃 22	83	67
〃 23	96	55
〃 24	148	42
〃 25	155	52
〃 26	129	44
〃 27	140	56
〃 28	162	35
比較例 1	105	84
〃 2	115	0
〃 3	112	1
〃 4	128	0
〃 5	96	3
〃 6	63	8
〃 7	101	42
〃 8	54	75

[0171]

表８　磁気カードの再生出力

	b_2 (210FCI)/b_1 (420FCI) (%)	
	領域B	
	直流消磁後、420FCIを記録し、その後210FCIを重ね記録	永久磁石で磁化後、420FCIを記録し、その後210FCIを重ね記録
実施例　1	１０３	１０３
〃　2	１０２	１０３
〃　3	１０３	１０２
〃　4	１０１	１００
〃　5	１０５	１０３
〃　6	１０３	９９
〃　7	１０２	９８
〃　8	１００	９７
〃　9	１０２	９６
〃　１０	１０１	１０１
〃　１１	１０２	１０１
〃　１２	１００	１００
〃　１３	１０６	１０２
〃　１４	１０８	１０２
〃　１５	１０７	１０４
〃　１６	１１０	１０５
〃　１７	１１２	１０４

[0172]

表９　磁気カードの再生出力

	b_2 (210FCI)/b_1 (420FCI) (%)	
	領域B	
	直流消磁後、420FCIを記録し、その後210FCIを重ね記録	永久磁石で磁化後、420FCIを記録し、その後210FCIを重ね記録
実施例１８	１０１	１００
〃　１９	９８	９６
〃　２０	１０６	１０１
〃　２１	１０８	１０４
〃　２２	９２	９５
〃　２３	９２	９４
〃　２４	１０２	１００
〃　２５	１１０	１０６
〃　２６	１０８	１０４
〃　２７	１１７	１１６
〃　２８	１０８	１０６
比較例　1	１９	２０
〃　2	１０２	９９
〃　3	１０１	１００
〃　4	１０４	１０１
〃　5	９９	９０

[0173]

表１０　磁気カードの再生出力

	b_2 (210FCI)/b_1 (420FCI) (%)	
	領域B	
	直流消磁後、420FCIを記録し、その後210FCIを重ね記録	永久磁石で磁化後、420FCIを記録し、その後210FCIを重ね記録
比較例　6	７６	８１
〃　7	１０６（再生減磁大）	１０６（再生減磁大）
〃　8	９０	８３

[0174] a2 / a1 of a signal recorded on Field A in the card which added the barium-ferrite magnetism powder and MnBi magnetism powder of coercive force 1750Oe shown in examples 1-9, so that the content of MnBi magnetism powder increased It becomes large. Once it shows that the difficulty of rewriting is increasing and records it so that the content of this of MnBi magnetism powder increases, rewriting will depend it on the property peculiar to MnBi magnetism powder which becomes difficult.

[0175] b2 / b1 of a signal recorded on Field B on the other hand It is not dependent on the content of MnBi magnetism powder, and it is almost as fixed as 100 - 105%, and it is shown that rewriting of a signal was performed satisfactory. Even if this contains MnBi magnetism powder, before recording it, it impresses a magnetic field and is because MnBi magnetism powder was magnetized, it stops having contributed to subsequent record reproduction and record reproduction was performed by the barium-ferrite magnetism powder of coercive force 1750Oe by having carried out direct-current demagnetization. In addition, b2 / b1 A big value is shown for a while from 100%, without a value becoming 100%, because recording density is obtained for the direction of 210FCI(s) and high power is obtained for the direction of 210FCI compared with 420FCI for a low reason.

[0176] Moreover, a2 / a1 of a signal recorded on Field A, so that the content of MnBi magnetism powder increased The inclination which becomes large is accepted also in the card of the examples 10-12 which used the barium-ferrite magnetism powder of coercive force 2850Oe, and the examples 13-15 using the cobalt content iron-oxide magnetism powder of coercive force 650Oe.

[0177] Moreover, the magnetic powder added with MnBi magnetism powder as shown in examples 16-23 also sets in the end of gamma-acid-ized iron powder to magnetite magnetism powder, strontium-ferrite magnetism powder, the barium-ferrite magnetism powder of high coercive force, metal magnetism powder, chromium-dioxide magnetism powder, samarium cobalt magnetism powder, and neodium iron boron magnetism powder, and it is the signal a2 of Field A / a1. It is indicated to be 30 - 67% that rewriting has the difficult property clearly.

[0178] The signal b2 / b1 recorded on Field B on the other hand At the examples 22 and 23 which made samarium cobalt magnetism powder and neodium iron boron magnetism powder contain, since the coercive force of magnetic powder is large, a value is b2 / b1. Rewriting is fundamentally possible although a low value is shown a little. At other examples, it is b2 / b1 in any example. The value near 100% is shown and it is shown that rewriting is performed satisfactory.

[0179] Moreover, it also sets, when a permanent magnet is used as a method of impressing a magnetic field, before recording the signal for demonstrating the easy property of rewriting in Field B, and it is b2 / b1. The value shows the value almost equivalent to the case where a magnetic field is impressed, by the magnetic head, and shows that rewriting is performed satisfactory.

[0180] Furthermore, the magnetic layer containing MnBi magnetism powder and the magnetic layer containing the barium-ferrite magnetism powder of coercive force 2850Oe The card using the magnetic-recording medium of the examples 24 and 25 which carried out the laminating to a lower layer and the upper layer or the upper layer, and the lower layer, respectively, The magnetic layer containing MnBi magnetism powder, and the magnetic layer containing Co content iron-oxide magnetism powder of coercive force 650Oe The card using the magnetic-recording medium of the examples 26 and 27 which carried out the laminating to a lower layer and the upper layer or the upper layer, and the lower layer, respectively, The magnetic layer which furthermore contains the barium-ferrite magnetism powder of coercive force 2850Oe in a lower layer Also in which card using the magnetic-recording medium of the example 28 which carried out the laminating of the magnetic layer which made the upper layer contain MnBi magnetism powder and cobalt content iron-oxide magnetism powder a2 / a1 A big value is indicated to be 35 - 56%, and b2/b1 shows the value near 100%, Field A is difficult to rewrite and Field B shows that rewriting is performed satisfactory.

[0181] a2 / a1 recorded on Field A on the other hand in the card of the example 1 of comparison which used only MnBi magnetism powder It is b2 recorded on Field B although the value was as high as 84%, and rewriting was natural while it was very difficult / b1. It does not have the performance which a value is as low as 19 - 20%, and can be rewritten.

[0182] Moreover, in the card of the examples 2, 3, and 5 of comparison which used only barium-ferrite magnetism powder,

coercive force even sets on the card of the example 5 of comparison of 5500Oe(s), and it is a2 / a1. A value is only 3% and rewriting hardly shows a difficult property. Moreover, also in the card of the example 4 of comparison which used only Co content iron-oxide magnetism powder, it turns out that the property with difficult rewriting is not shown like the card which used only barium-ferrite magnetism powder.

[0183] Furthermore, a2 / a1 recorded on Field A in the card of the example 6 of comparison which used the samarium cobalt magnetism powder of high coercive force A value is b2 recorded on Field B although it is 8% and rewriting showed the difficult property to some extent / b1. A value is as low as 76% and remaining without rewriting the signal recorded before is shown.

[0184] Moreover, it also sets on the card which added MnBi magnetism powder and other magnetic powder. The signal a2 / a1 recorded on Field A with the card of the example 7 of comparison with which the coercive force of the gamma-acid-ized ferromagnetism powder added with MnBi magnetism powder added 280Oe(s) and low magnetism powder The signal b2 / b1 which showed the big value and was recorded on Field B About 100% of value is shown. However, the inclination which will be demagnetized if the signal recorded on Field B is repeated and it reproduces was accepted. This is considered to be the phenomenon produced since the difference in the coercive force of the MnBi magnetism powder in which the very big coercive force of 10000 or more Oes is shown after record, and gamma-acid-ized ferromagnetism powder was too large.

[0185] Furthermore, since the coercive force of the magnetic powder added with MnBi magnetism powder is too large in the card which added the MnBi magnetism powder and neodium iron boron magnetism powder which are shown in the example 8 of comparison, it is b2 / b1. The value of the output (a1) of a value not only becoming quite lower than 100% but a card itself is also a low. Since this has the too large coercive force of the magnetic powder added with MnBi magnetism powder, it is because the signal is not fully written in this magnetic powder.

[0186] Thus, the property of having the field where the card shown in the examples 1-6 of comparison is difficult to rewrite, and the field where rewriting is easy is not shown. Moreover, in some for which the coercive force of the magnetic powder added with MnBi magnetism powder also in the card shown in the examples 7 and 8 of comparison used the magnetic powder of 300-8000Oe out of range, there are problems, like reproduction demagnetization and the reproduction output itself are low.

[0187] On the other hand, with the card of an example using the magnetic-recording medium of this invention, it turns out that it is not based on the kind of magnetic powder used with MnBi magnetism powder, but rewriting has the property of having a difficult field and the field where rewriting is easy by any [in the case of carrying out the laminating of the magnetic layer which is made to add with MnBi magnetism powder, or contains these magnetic powder] case.

[0188] Moreover, as an example which applied the magnetic-recording medium of this invention to the magnetic card, the example applied to drawing 4 -8 at PURIPE-DOKA-DO is shown. Drawing 4 shows the example which made the truck of another side Field B (field which can perform rewriting of data arbitrarily) for the truck of one of the two of an adjoining truck to Field A (it is the field where rewriting is difficult once it records a signal). Drawing 5 forms a magnetic track in the upper and lower sides of a card, and shows the example which made the truck of another side Field B for one of the two's truck to Field A. Drawing 6 shows the example which made other two trucks Field B for one truck to Field A among three adjoining magnetic tracks. Drawing 7 forms a magnetic track in the upper and lower sides of a card, and shows up the example which formed two of one truck of Field B for the truck of Field A caudad. Moreover, drawing 8 shows the example which formed each two TORAKKUTO of Field A and Field B in the upper and lower sides of a card. Although this example shows the typical example, it cannot be overemphasized that various kinds of combination is possible using Field A and Field B besides these examples.

[0189] Other examples of the record reproduction method are explained to production of an example 30 <<magnetic card, and the magnetic-recording medium of a record reproduction method>> this invention. As a card, the paint film shown in the example 1 was formed, and it produced by the method as well as the method shown in the example 29. It initialized by the method which showed this card to the example 29.

[0190] Like [record of a signal] the example 29, using the magnetic card reader writer (CRSmade from Sanwa new tech- 700), record current was made into 200mA and recording density recorded the square wave of 210FCI(s) and 420FCI(s). Using the same magnetic card reader writer, reproduction of a signal also made it go via a band pass filter, incorporated the signal from the magnetic head in the oscilloscope, and asked for the reproduction output of 210FCI and 420FCI(s) from the wave amplitude of an oscilloscope.

[0191] Once it recorded the signal, it recorded with composition as shows the field (field A) where rewriting is difficult, and the field (field B) which can perform rewriting of a signal arbitrarily to drawing 9 . First, on the arbitrary truck of the magnetic layer of a magnetic card, the square wave of 420FCI(s) was recorded by width of face of 10mm from the left end of a card, next the interval of 10mm was opened and the square wave of 420FCI(s) was again recorded by width of face of 10mm. Three record sections (field A) were formed by this repeat.

[0192] Next, after impressing the direct-current magnetic field of on-the-strength abbreviation 3000Oe to this whole card and being magnetized uniformly, the square wave of 420FCI(s) was recorded as well as a different field (field B) from the field (field A) previously recorded on the same truck. Then, the signal of 210FCI(s) was piled up and recorded on this whole truck. The difficulty of rewriting and the ease of rewriting are a2 / a1 as well as an example 29. And b2 / b1 It evaluated from the value.

[0193] That is, about Field A, the reproduction output (a1) of the signal of 420FCI(s) recorded first and the reproduction output (a2) of the signal of 420FCI(s) after recording the signal of 210FCI in piles were measured. Moreover, the reproduction output (b1) of the signal of 420FCI(s) recorded after impressing direct-current magnetization and being magnetized about Field B was measured, next the signal of recording density 210FCI was piled up and recorded, and the reproduction output (b2) of the signal of 210FCI was measured.

[0194] this (a2 / a1) -- and (b2 / b1) turned out that a value became 41% and 102%, respectively, and it had the property of having the field where rewriting of this invention is difficult, and the field where rewriting is easy, also in the card of such composition

[0195] Drawing 10 shows the simpleest example in which the field (field A) where rewriting is difficult, and the field (field B) where rewriting is easy were formed in one truck. Drawing 11 is the example which formed Field A and Field B in one truck, and made one more truck Field B. Drawing 12 is the example in which two or more trucks in which two or more fields A and fields B were formed in one truck were formed. Moreover, drawing 13 is the example which formed Field A and Field B in one truck, and made other trucks Field A and Field B.

[0196] Production of an example 31 <<magnetic card, and the record reproduction method Other examples of the record reproduction method are explained to the magnetic-recording medium of>> this invention. As a card, the paint film shown in the example 1 was formed, and it produced by the method as well as the method shown in the example 29. It initialized by the method which showed this card to the example 29.

[0197] Like [record of a signal] the example 29, using the magnetic card reader writer (CRSmade from Sanwa new tech- 700), record current was made into 200mA and recording density recorded the square wave of 210FCI(s) and 420FCI(s). Using the same magnetic card reader writer, reproduction of a signal also made it go via a band pass filter, incorporated the signal from the magnetic head in the oscilloscope, and asked for the reproduction output of 210FCI and 420FCI(s) from the wave amplitude of an oscilloscope.

[0198] By this example, once it records a signal, the example which prepared further the field where rewriting is difficult, and the field which recorded the positional information for recording these signals other than the field which can perform rewriting of a signal arbitrarily on a specific field is shown. The card shown in this example makes into the field C which records the signal which recorded the positional information for recording the signal with which rewriting can do one truck arbitrarily with a signal with difficult rewriting once it records a signal on a specific field, as shown in drawing 14 , forms the field (field A) where rewriting is difficult in one more truck, and the field (field B) where rewriting is easy, and is constituted.

[0199] First, once it records a signal on the truck of the magnetic layer of a magnetic card, a signal with difficult rewriting and the signal which recorded the positional information for recording the signal which can do rewriting arbitrarily on a specific field will be recorded. next, this positional information -- a basis -- a signal with rewriting difficult on ****** and other trucks and the signal whose rewriting is possible are recorded

[0200] In this example, it considered as the same record composition as an example 29. That is, the square wave of 420FCI(s) was recorded by width of face of 10mm from the left end of a card, next the interval of 10mm was opened and the square wave of 420FCI(s) was again recorded by width of face of 10mm. Three record sections (field A) were recorded by this repeat.

[0201] Next, also including the truck which recorded positional information, the direct-current magnetic field of on-the-strength abbreviation 3000Oe was impressed to this whole card, and it was magnetized uniformly. Then, similarly based on this positional information, the square wave of 420FCI(s) was recorded on a different field (field B) from the field (field A) recorded previously. Then, the signal of 210FCI(s) was piled up and recorded on this whole truck. And (b2 / b1) is the same with examples 29 and 30 (a2 / a1), and the difficulty of rewriting and the ease of rewriting were evaluated from the value.

[0202] this (a2 / a1) -- and (b2 / b1) turned out that a value became 42% and 103%, respectively, and it had the property of having the field where rewriting is difficult, and the field where rewriting is easy, like the card of examples 29 and 30 also in the card of such composition

[0203] Moreover, although the card of composition of having made each into one the truck which recorded positional information, and the truck in which Field A and Field B were formed was mentioned as the example and the example 31 explained it, if it forms in two or more trucks as shown in drawing 15 , security nature will improve further. Moreover, this example showed the example which recorded Field A and Field B at equal intervals. However, it is not necessary to record Field A and Field B at equal intervals, and in forming the field C which recorded positional information and setting up Field A and Field B according to this information, as shown in drawing 16 and drawing 17 , the direction of security nature where the recording widths of Field A and Field B differ improves. If Field C, Field A, and Field B which recorded positional information are made intermingled in one truck and are formed as furthermore shown in drawing 18 , security nature will improve further.

[0204] Production of an example 32 <<magnetic card, and the record reproduction method Other examples of the record reproduction method to the magnetic-recording medium of>> this invention are explained. As a card, the paint film shown in the example 24 was formed, and it produced by the method shown in the example 29, and the same method, and initialized. This paint film has the structure to which the laminating of the magnetic layer which contains barium-ferrite magnetism powder on the magnetic layer containing MnBi magnetism powder was carried out.

[0205] By this example, once it records a signal, the example which rewriting uses as a difficult field in distinction from the field (lead-only function) which has written in the signal beforehand, and the field (write-once function) which use writes in the degree of capital will be explained. Record of a signal and reproduction were performed by the following methods.

[0206] <Rewrite function> Direct-current demagnetization of the one truck on a magnetic layer side was carried out with 200mA of record current using the magnetic card reader writer (; made from a Sanwa new tech CRS- 700). Next, ten numbers from zero to nine were recorded on this truck as data a with 200mA of record current.

[0207] Next, when this truck was reproduced using the same magnetic card reader writer, Data a were reproduced correctly.

[0208] Next, ten characters from A to J were piled up and recorded on the truck which recorded Data a as data b. When this truck is reproduced, Data b are reproduced, data are rewritten normally, and it checked having the rewrite function.

[0209] <Write-once function> Using the magnetic card reader writer (; made from a Sanwa new tech CRS- 700), the above-mentioned rewrite truck is 200mA of record current, and recorded ten numbers from zero to nine on a different truck as data a.
[0210] Next, when this truck was reproduced using the same magnetic card reader writer, Data a were reproduced correctly.
[0211] Next, over-writing record of the ten characters from A to J was carried out as data b on this truck with 200mA of record current using the same magnetic card reader writer. When this truck was reproduced, it became a reproduction error, and reproduction was impossible. Since Data b are recorded on the upper layer by which Data a contain barium-ferrite magnetism powder in the lower layer containing MnBi magnetism powder, and data which are different on one truck pile up and are recorded, data are intermingled, and this causes and makes a reproduction error. Therefore, it checked that this field had the write-once function.
[0212] <Lead-only function> Using the magnetic card reader writer (; made from a Sanwa new tech CRS- 700), the aforementioned rewrite truck and a write-once truck are 200mA of record current, and recorded ten numbers from zero to nine on a different truck as data a.
[0213] Next, using the same magnetic card reader writer, this truck was reproduced, after carrying out direct-current demagnetization with 200mA of record current. Reproduction data were ten numbers from 0 to 9, and the recorded data a were reproduced normally and it checked having the lead-only function.
[0214] As example 33 card, the paint film shown in the example 1 was formed, and the card was produced by the method shown in the example 29, and the same method, and it initialized.
[0215] As the record reproduction method of a signal, like the example 32, once it recorded the signal, rewriting used it as a difficult field in distinction from the field (lead-only function) which has written in the signal beforehand, and the field (write-once function) which use writes in the degree of capital.
[0216] It checked that all functions operated normally also in this card by the same method as an example 32 when a rewrite function, a write-once function, and a lead-only function are investigated.
[0217] Only the MnBi magnetism powder shown in the example 1 of example of comparison 9 comparison was used, and the card was produced by the method shown in the example 29, and the same method, and it initialized.
[0218] Next, the card was produced by the same method as an example 32, and the rewrite function, the write-once function, and the lead-only function were investigated by the same method.
[0219] The rewrite function was not accepted although it was admitted with the card of this example of comparison only using MnBi magnetism powder that a write-once function and a lead-only function operated like the card of examples 32 and 33.
[0220] Only the barium-ferrite magnetism powder shown in the example 3 of example of comparison 10 comparison was used, and the card was produced by the method shown in the example 29, and the same method, and it initialized.
[0221] Next, the card was produced by the same method as an example 32, and the rewrite function, the write-once function, and the lead-only function were investigated by the same method.
[0222] With the card of this example of comparison only using barium-ferrite magnetism powder, it was admitted that a rewrite function operated like the card of examples 32 and 33. However, the data a (ten numbers to 9) recorded first are rewritten by the data b (ten characters from A to J) recorded later, and the write-once function was not accepted. Moreover, when direct-current demagnetization was carried out, the data a (ten numbers to 9) recorded first will be eliminated, and the lead-only function was not accepted.
[0223] Although the case where the barium-ferrite magnetism powder of coercive force 2850Oe was used was mentioned as the example and the examples 32 and 33 which investigated three kinds of functions, a rewrite function, a write-once function, and a lead-only function, explained it as magnetic powder used with MnBi magnetism powder As mentioned already, as magnetic powder used with MnBi magnetism powder All of the magnetic powder of 300Oe(s) to 8000Oe(s) have the suitably usable coercive force when impressing the magnetic field of 16kOe(s) in 300K in the magnetic powder in which record, elimination, and rewriting are possible by the magnetic head. For example, gamma-acid-ized ferromagnetism powder, cobalt content iron-oxide magnetism powder, strontium-ferrite magnetism powder, metal ferromagnetism powder, iron cobalt alloy magnetism powder, samarium cobalt magnetism powder, or neodium iron boron magnetism powder is raised as a suitable thing.
[0224] Since the balance of a rewrite output, a write-once output, and a lead-only output changes by changing a mixed rate in mixing and using MnBi magnetism powder and other magnetic powder, it is desirable to adjust a mixed rate according to the purpose of use. this mixture -- if it carries out comparatively -- the rate of MnBi magnetism powder and other magnetic powder -- 1:9 to 9:1 -- if it carries out to 2:8 to about 8:2 more preferably, the balance of a rewrite output, a write-once output, and a lead-only output will become good
[0225] Moreover, when considering as multilayer structure, it is desirable to usually set thickness of each magnetic layer to about 1-20 micrometers, and to set magnetic layer thickness as the whole to about 2-30 micrometers. Since the balance of a rewrite output, a write-once output, and a lead-only output changes by changing the thickness of each magnetic layer, as for the thickness of each magnetic layer, adjusting according to the purpose of use is desirable.
[0226] Furthermore, as a field which has a rewrite function, a write-once function, and a lead-only function, it is also possible to also give one kind of function to one truck and to give one kind of function to the truck of several others. Moreover, it is also possible to give two kinds or three kinds of functions in one truck.
[0227] The example of use of the card which has a rewrite function, a write-once function, and a lead-only function in drawing 19 - drawing 33 is shown. The truck with which one has a magnetic layer among each drawing, and 2 has a lead-only function or a

field, the truck with which 3 has a write-once function or a field, and 4 are the trucks or fields which have a rewrite function. Drawing 19 - drawing 22 are the examples which gave one kind of function to one truck. Drawing 23 - drawing 33 are the examples which gave two kinds or three kinds of functions to one truck.

[0228] These examples show an example at the time of applying the magnetic-recording medium of this invention to a card. By putting together and using three kinds of functions, a lead-only function, a rewrite function, and a write-once function, according to a use, the powerful security nature which has not been realized can be demonstrated with an old card.

[0229]

[Effect of the Invention] As explained above, the magnetic-recording medium of this invention By MnBi magnetism powder and the magnetic head, record, elimination, rewritable magnetic powder, The magnetic powder which has the coercive force which impressed and measured the magnetic field of 16kOe(s) in 300K suitably in the range of 300Oe(s) to 8000Oe(s) By carrying out the laminating of the magnetic layer which adds so that it may express with a weight ratio and may become the range of 9:1 from 1:9, or contains these magnetic powder, once it records a signal, subsequent rewriting will realize the property of having a very difficult field and the field which can perform rewriting of a signal arbitrarily.

[0230] Moreover, after impressing a magnetic field to this field first and being magnetized, it is recordable on the field (rewrite function) which subsequent rewriting can perform it by the same method as the usual magnetic-recording medium to a very difficult field (a write-once function, lead-only function) once record of the signal of this medium records a signal, and can perform rewriting of a signal arbitrarily by the usual method.

[0231] Moreover, once it records a signal, subsequent rewriting is able to use it as a very difficult field in distinction from the field (lead-only function) which has written in the signal beforehand, and the field (write-once function) which use writes in the degree of capital.

[0232] If the magnetic-recording medium of this invention is applied to a magnetic card, big power will be demonstrated especially. For example, when it applies to PURIPE-DOKA-DO, a magnetic commuter pass, and a magnetic ticket, two kinds or three kinds of above-mentioned signals can be recorded on the same truck of a magnetic layer, or a different truck. It is very effective if it writes in beforehand at the time of the initial amount of money which must not be altered by the field where subsequent rewriting is very difficult once it records a signal by doing in this way, or the date of issue. Moreover, in this field, it is also possible to use the use amount of money for postscript record which carries out marking magnetically instead of making a punch hole.

[0233] The data which rewrite data at every use of a card are recordable on the field which can perform rewriting of a signal arbitrarily. It does not exist until now, but it begins by the magnetic-recording medium of this invention, and realizes, and the magnetic-recording medium with such a property is a magnetic-recording medium with very high practical value.

[0234] Moreover, as mentioned already, in order to spread a usually new medium in a commercial scene, it is necessary to also newly develop the recording device and reader for using the medium, and to spread these equipments. However, it is in a very difficult situation to already replace all of these equipments in the present condition that record and the reader have spread, like a magnetic card to all the corners in the world.

[0235] The record and the reader which are only record of data, the kind of magnetic field added at the time of reproduction, and the combination of the sequence of adding a magnetic field, and have spread fundamentally now can be used for the magnetic-recording medium of this invention as it is, and it can make a rewrite function, a write-once function, and a lead-only function discover. Thus, impact is so large that the powerful thing for which security exertion can be carried out is planned and is not found from a practical standpoint, maintaining a present card and present compatibility, without changing most present equipments.

[Translation done.]